# Chapter 6
# NATURAL SYSTEMS

## GOALS

The following state natural system goals have been outlined by the Florida Legislature:

- Conserve forests, wetlands, fish, marine life, and wildlife to maintain their environmental, economic, aesthetic, and recreational values (Section 187.201(10)(b)1, F.S.)
- Reserve from use that water necessary to support essential nonwithdrawal demands, including navigation, recreation, and protection of fish and wildlife (Section 187.201(8)(b)14, F.S.)
- Protect the functions of entire ecological systems through enhanced coordination of public land acquisition, regulatory, and planning programs (Section 94-356, 2(c), Laws of Florida)
- The Florida Legislature hereby declares the policy of the state to be management and preservation of its renewable marine fishery resources, based upon the best available information, emphasizing protection and enhancement of the marine and estuarine environment in a manner as to provide for optimum sustained benefits and use to all the people of the state for present and future generations (Section 370.025(1), F.S.)

In order to preserve, enhance, and restore the water resource related natural systems within its boundaries, the SFWMD is committed to the following goals:

- Preserve native ecosystems, along with their water resource related functions
- Restore altered ecosystems, where appropriate, along with their water resource related functions

## RESOURCE ASSESSMENT

Two main elements of the District's natural system management efforts are ecosystem protection and ecosystem restoration.

### Ecosystem Protection

The primary components of ecosystem protection include activities such as establishment and implementation of Minimum Flows and Levels (MFLs), the Save Our Rivers (SOR) program, and wetlands regulation.

## Minimum Flows and Levels

### Definition

The establishment of minimum flows for surface watercourses and levels for both surface waters and aquifers is critical to maintaining environmental quality. In recognition of this fact, the Florida Legislature has mandated that all water management districts establish MFLs for water bodies within their jurisdictions (Section 373.042, F.S.). Minimum flows for watercourses (generally rivers, streams, or the flow of fresh water into an estuary) represent the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. Minimum levels are the level of ground water in an aquifer and/or the level of surface water (generally in a lake or wetland) below which further withdrawals would be significantly harmful to the water resources.

In 1997 the Florida Legislature provided additional guidance (Section 373.0421, F.S.) concerning establishment of MFLs:

> (1)(a) Considerations.—When establishing minimum flows and levels pursuant to s. 373.042, the department or the governing board shall consider changes and structural alterations to watersheds, surface waters, and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed, on the hydrology of an affected watershed, surface water, or aquifer, provided that nothing in this paragraph shall allow significant harm as provided by s. 373.042(1) caused by withdrawals.
>
> (b) Exclusions.—
>
> 1. The Legislature recognizes that certain water bodies no longer serve their historical hydrologic functions. The Legislature also recognizes that recovery of these water bodies to historical hydrologic conditions may not be economically or technically feasible, and that such recovery effort could cause adverse environmental or hydrologic impacts. Accordingly, the department or governing board may determine that setting a minimum flow or level for such a water body based on its historical condition is not appropriate.
>
> 2. The department or the governing board is not required to establish minimum flows or levels pursuant to s. 373.042 for surface water bodies less than 25 acres in area, unless the water body or bodies, individually or cumulatively, have significant economic, environmental, or hydrologic value.
>
> 3. The department or the governing board shall not set minimum flows or levels pursuant to s. 373.042 for surface water bodies constructed prior to requirement for a permit, or pursuant to an exemption, a permit, or a reclamation plan which regulates the size, depth, or function of the surface water body under the provisions of this chapter (373), chapter

> 378, or chapter 403, unless the constructed surface water body is of significant hydrologic value or is an essential element of the water resources of the area.
>
> The exclusions of this paragraph shall not apply to the Everglades Protection Area, as defined in s. 373.4592(2)(h).

### MFL Schedules

The *1998 District Water Management Plan Annual Report* (SFWMD, 1998a) included a schedule for establishing MFLs for priority water bodies within the District. Chapter 373.04(2), F.S., requires the District to annually review the priority list and schedule and, with Florida Department of Environmental Protection (FDEP) approval, make necessary updates and revisions. In November 1999, the SFWMD submitted a revised priority list and schedule to the FDEP. Future DWMP annual reports will include updated priority lists and schedules.

### Proposed Criteria

In July 1998, the District published the revised draft document entitled *Proposed Minimum Water Level Criteria for Lake Okeechobee, the Everglades, and the Biscayne Aquifer within the South Florida Water Management District* (SFWMD, 1998e), and authorized staff to conduct a voluntary peer review of the draft document. The revised document presents the technical basis for establishing MFL criteria for Lake Okeechobee, the Water Conservation Areas (WCAs), the Holey Land and Rotenberger Wildlife Management Areas (WMAs), Everglades National Park, and the coastal Biscayne aquifer. The report also provides a definition of significant harm which states "…Significant harm is defined as a loss of specific water resource functions that take multiple years to recover, which result from a change in surface water or ground water hydrology…". The report also provides a conceptual relationship of the term significant harm to the consumptive use permitting standard of harm, and water shortage serious harm standard as presented in **Figure 27**.

### Public Workshop and Peer Review

In August 1998, District staff held a two-day public workshop to conduct an independent, scientific, peer review of the draft MFL technical document. At this meeting District staff presented the proposed MFL criteria to an expert panel of scientists. The panel also listened to comments provided by members of the public and staff representing the various agencies that have management responsibilities for these areas (e.g., the Florida Fish and Wildlife Conservation Commission (FWC)[1], FDEP, Everglades National Park, Biscayne Bay National Park, and the U.S. Geological Survey (USGS).

1. The Florida Fish and Wildlife Conservation Commission (FWC) was formerly known as the Florida Game and Fresh Water Fish Commission (FGFWFC).

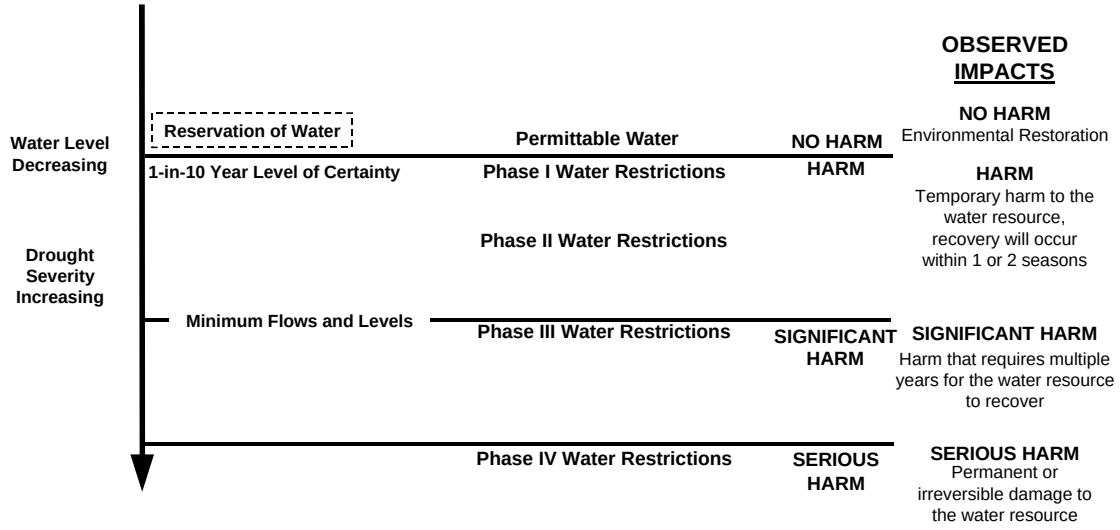


**Figure 27.** Conceptual Relationship Between Harm, Significant Harm, and Serious Harm.

In September 1998, the final report of the scientific peer review panel was posted on the internet for public review and comment. In October 1998, the peer review panel presented the results of their findings to the Governing Board. Major conclusions of the review included the following:

- The draft document presents a logical, well-supported case for the proposed MFL criteria
- The recommendations are backed by reference to appropriate scientific findings in published literature and SFWMD experience and research
- The report made a clear connection between policy foundations and the reviewable technical issues
- The issue of significant harm was clear for each priority water body

With regards to concerns expressed by members of the public concerning Florida Bay and Biscayne Bay the panel did the following:

- The panel concluded that it is possible to set initial MFLs for the three hydrologic systems under consideration prior to setting MFLs for the other systems
- The panel recommended that MFLs for Florida Bay and Biscayne Bay be moved up in the District's MFL priority list

### Sufficiency Review

The panel has recommended that a sufficiency review should be conducted to determine if any new data or information has surfaced that illustrates the relationships between ecosystem water levels, flows, and bay and estuary water and salinity levels. A sufficiency review of the required information necessary to develop MFLs for Florida Bay

and Biscayne Bay was completed. In November 1999, the District submitted a revised priority list to FDEP and it was accepted in December 1999.

In addition, as part of the Lower East Coast (LEC) regional water supply planning process, the District has initiated the process of developing a MFL Prevention and Recovery Plan. This plan will accomplish the following tasks:

- Identify water resource development projects and strategies necessary to achieve recovery and to prevent levels from falling below the minimum
- Develop a timetable and phased schedule for implementation of additional water supplies to ensure sufficient water for existing and projected uses

## Save Our Rivers

Placing land in public ownership is a major option available to protect environmentally sensitive lands. In 1981, the Florida Legislature enacted the Save Our Rivers (SOR) Program. The legislation created the Water Management Land Trust Fund (Section 373.59, F.S.), which receives revenues from documentary stamp taxes and is administered by the FDEP. Funds are also added to this program from the Florida Preservation Trust Fund, created through the Preservation 2000 Act in 1990 and the Florida Forever Act in 1999. Implementation tools of the SOR Program include land acquisition, land management, cooperative management agreements for public use, and environmental education.

### Land Acquisition

Water management districts may use SOR funds for the acquisition of fee simple, or other interest, in lands necessary for water management, water supply, and the conservation and protection of water resources. From 1981 to June 1999, approximately 359,000 acres were acquired at a cost of more than $550 million.

Applications to consider a particular land parcel for purchase under the SOR Program can be made by a landowner, private citizen, local government, or the SFWMD. Applications are accepted throughout the year and each spring the District reviews the new applications and proposes boundary adjustments. Site inspections are conducted and projects are scored using a land evaluation matrix. The matrix contains the following parameters that address a site's water resource and environmental values:

- Water Management
- Connectiveness
- Water Supply
- Species Diversity
- Conservation and Protection of Water Resources

- Vulnerability
- Rarity
- Manageability
- Nature Oriented Human Use
- Habitat Diversity

The resulting scores are the basis for the recommendations of the Land Selection Committee, comprised of senior level SFWMD managers. The Land Selection Committee meets in an advertised public meeting to discuss staff recommendations and, in turn, recommends a work plan to the Governing Board. Taxpayers from several South Florida counties have passed local bond issues for the acquisition of environmentally sensitive land. Wherever possible, the SFWMD has worked with local governments to acquire lands that are on both regional and county lists. **Table 16** indicates projects that were on the 1999 priority list for acquisition and management, and identifies the entities that are working in partnership with the District to implement these projects.

**Table 16.** 1999 Land Acquisition and Management Plan for Save Our River Projects.

| Project | Acquisition Partner |
|---|---|
| Allapattah Ranch | Conservation and Recreational Lands (CARL) |
| Atlantic Ridge Ecosystem | CARL |
| Corkscrew Regional Ecosystem Watershed | CARL |
| East Coast Buffer | CARL |
| Florida Bay (Southern Glades, Model Lands, L-31N) | CARL/Miami-Dade County |
| Kissimmee River | None |
| Lake Walk-in-Water | Polk County |
| Loxahatchee Slough | None |
| McDaniel Ranch | None |
| North Fork St. Lucie River | CARL/St. Lucie County |
| West Jupiter Wetlands (Pal-Mar) | CARL/Martin and St. Lucie counties |
| Shingle Creek | Mitigation |
| Stormwater Treatment Areas (STAs) | Federal Government |
| Ten Mile Creek | Federal Government |
| Twelve Mile Slough | CARL |

## Land Management

Land management under the SOR Program focuses on the following areas:

- Hydrologic restoration - wetland restoration and the establishment of sheetflow conditions, where possible
- Prescribed burning - wildfire prevention, fuel load reduction, and ecological burning for habitat enhancement
- Exotic plant control - treatment of invasive exotic vegetation by the use of approved chemical herbicides with trained applicators
- Habitat protection and enhancement - posting, fencing, and providing physical security; maintenance of disturbed habitats through mowing, chopping, and disking; and general maintenance activities

The District has also acquired numerous parcels of land for future restoration, water quality treatment, and/or water resource development projects, for which planning and design are under way. On an interim basis, until such time as construction is initiated, existing agricultural land uses are being continued as a means of managing these lands. A competitive bid process is used to solicit proposals and award contracts, which include the appropriate cancellation clauses so the land is available when needed. The benefits of this interim use include the following:

- On-site property manager provided at no cost to the District
- On-site exotic control, use of Best Management Practices (BMPs), fencing, etc., mandated as contract conditions
- Income generated helps offset District acquisition and future project costs
- Property remains on the local county tax rolls until it is actually needed by the District
- Continued use of the property supports the local agricultural economy

Land management activities by the District continue to be uncertain, since the District has not been given clear direction concerning its future role in long-term management of lands that have been acquired to protect or preserve natural systems.

## Cooperative Management Agreements

In addition to agreements with the FWC, the District has entered into cooperative agreements with other state agencies, local governments, and the private sector for assistance in the management of certain SOR lands. In most cases, the SFWMD has a Memorandum of Agreement (MOA) and an annual work plan that detail services and compensation. The cooperators provide many services for which the SFWMD does not pay, including managerial, planning, and administrative support from the organization’s headquarters staff, and specialized services, such as law enforcement and management of public hunting.

### Public Use

Public recreational opportunities are being developed on SOR lands where such uses are appropriate. Hiking and equestrian trails and primitive back country camp sites have been planned and developed by the SFWMD, in cooperation with volunteers from the Florida Trail Association and local horsemen's clubs. The trail systems enable visitors to see and enjoy these sensitive lands with minimal impact to the resource.

Public hunting is also allowed on certain SOR properties and is managed by the FWC through cooperative agreements with the SFWMD. Special regulations established by the FWC restrict the number of hunters, establish bag limits, and restrict use of dogs and off-road vehicles.

## Wetlands Regulation

Since 1974, pursuant to the Water Resources Act of 1972 (Chapter 373, F.S.), the SFWMD has regulated wetlands through its Surface Water Management Permitting Program. For the first few years, the regulatory program focused primarily on drainage and flood protection and little attention was given to wetland protection or environmental considerations. Revisions to the SFWMD's rules during the 1980s included the addition of criteria to protect wetlands. The rules remained relatively flexible regarding wetland protection, requiring more protective measures for wetlands that comprised larger systems and were deemed to be directly related to the water resources of the District. The emphasis of early wetland regulatory criteria was to achieve protection of larger environmental systems. The regulatory program evolved over the years, and in 1987 the District's Isolated Wetlands Rule was adopted (Chapter 40E-4, F.A.C.) to provide additional protection to wetland systems.

### FDEP Dredge and Fill Delegation

Changes in the regulatory program were implemented under the terms of an operating agreement, approved in 1992, between the SFWMD and FDEP. In November 1992, the SFWMD began reviewing certain dredge and fill activities proposed in FDEP jurisdictional wetlands. The operating agreement specified the type of projects in which the SFWMD could authorize dredging or filling activities in FDEP jurisdictional wetlands. The delegation agreement was the first step towards achieving a one-stop permitting program in Florida.

### Environmental Resource Permitting

The Florida Environmental Reorganization Act of 1993 consolidated dredge and fill permitting activities and surface water management permitting activities into one program implemented through Chapter 373, F.S. The rules governing the implementation of the Environmental Resource Permit (ERP) Program went into effect in October, 1995. The merging of the criteria for wetland and surface water management permitting resulted in only one permit being issued.

In October of 1995, the District began to process applications for the use of sovereign submerged lands when a proprietary authorization is required in conjunction with an ERP permit. The proprietary authorization for the use of sovereign submerged lands is governed by Chapters 253 and 258, F.S.

The ERP Program deals with the construction of surface water management systems and dredge and fill activities. Surface water management systems are required for all forms of development: agricultural, commercial, and residential. Developed sites, containing more impervious surfaces or altered topography, must provide a way to direct storm water to water management areas for water quality treatment and flood attenuation.

During the ERP application review process, wetlands are evaluated both on and adjacent to the project site. If wetland impacts are proposed in an ERP application, an analysis is conducted to determine if the impacts can be eliminated or reduced. If the proposed wetland impacts are determined to be permittable, an applicant will need to provide compensation for the loss of the wetland functions. Generally this is accomplished through mitigation. Mitigation consists of the restoration or enhancement of existing wetlands, the creation of new wetland habitat, or a combination of these methods.

If the applicant proposes to preserve the wetlands on the project site, an analysis is conducted to determine what effects the development will have on the wetlands. An applicant must ensure that an upland buffer exists, that adequate amounts of water will be available, that wetlands will not be inundated for prolonged periods, and that a conservation easement is provided to ensure long-term protection.

### Wetland Impact Due to Consumptive Use

Wetlands impacts are also reviewed through the Consumptive Use Permitting (CUP) program. Wetlands are identified during the review process and an analysis of potential impacts on wetland systems is performed. The potential drawdown effect on wetlands by wellfields or dewatering operations is often modeled by the applicant, as well as District staff, to determine the extent of potential impact. Adverse impacts to wetlands through dewatering or wellfield drawdowns cannot be permitted. If an adverse impact is identified, the application must be modified to eliminate the adverse impact or staff will recommend a reduced allocation. Development has begun on a rule that would allow limited drawdown under wetlands.

### Environmental Compliance

In 1989, the District completed an internal study assessing the ability of its regulatory program to manage and protect wetland resources. An independent company analyzed the program. As a result of those studies, a major initiative to develop a postpermit compliance program was undertaken in 1990, and the District has staffed a wetland mitigation compliance work unit since 1992. These staff review submitted monitoring reports and verify success criteria on-site. Mitigation sites are monitored for five years and thereafter site inspections are completed annually.

The District's compliance staff have inspected projects permitted with mitigation requirements and identified a number of noncompliance cases. Most of the cases have been resolved without the need for formal enforcement action.

## Ecosystem Restoration

The primary components of ecosystem restoration include planning activities such as natural resource restoration components of the Comprehensive Everglades Restoration Plan (CERP), Surface Water Improvement and Management (SWIM) plans and related projects, Kissimmee River restoration, Everglades restoration, Lake Okeechobee restoration, and control of exotic and nuisance plant species.

### Natural System Restoration Components of the CERP

Although some level of ecological improvement will occur in the South Florida ecosystem as a result of implementation of projects currently planned outside of the CERP (e.g., Kissimmee River restoration), the cumulative, regional benefits from these projects would not result in a sustainable South Florida ecosystem. Based on an evaluation of conditions projected for 2050, the overall health of the ecosystem will substantially deteriorate if the CERP is not implemented. The analyses show that making modifications to only some portions of the Central and Southern Florida Flood Control (C&SF) Project will not achieve sustainable natural systems.

An important component of the CERP is to restore natural communities within the study area that have been impacted by construction and operation of the C&SF Project. The primary types of impacts that have occurred include loss of wetlands due to land development, alteration of hydroperiods to provide too much or too little water at inappropriate times, and changes to species composition of wetland ecosystems due to degradation of water quality. These systems will be restored through a combination of land acquisition, creation of new lakes and short-hydroperiod wetlands, removal of existing canals and levees that impede the natural flow patterns, construction of new facilities to capture and distribute water, and efforts to provide improved depth, timing, and distribution of water throughout the Everglades. Details of the CERP are further described in **Chapter 2**.

## SWIM Plans and Projects

In addition to improvement of water quality, SWIM plans have also identified needs for restoration of natural ecosystem functions within the target water bodies. The basis for SWIM efforts is described in **Chapter 5**.

The SWIM legislation that was enacted in 1987 identified three priority water bodies within the SFWMD. The most recent revisions of SWIM plans were prepared in 1994 for Indian River Lagoon (SFWMD and SJRWMD, 1994), in 1995 for Biscayne Bay (SFWMD, 1995b), and in 1997 for Lake Okeechobee (SFWMD, 1997b). An additional water body, the Everglades, was identified through the SWIM priority setting process. A plan was completed in 1992 that identified the problems facing the Everglades, the resources that were threatened, probable causes, and proposed actions (SFWMD, 1992b). The Everglades SWIM Plan was subsequently superseded by the Everglades Protection Act and the Everglades Forever Act, which incorporated many of the actions proposed in the SWIM plan and directed how restoration efforts were to proceed. The Florida Legislature also indicated that no further SWIM planning efforts were to be conducted in the Everglades until the mandated recovery programs were completed. Locations of District SWIM planning areas are shown in **Figure 28.**

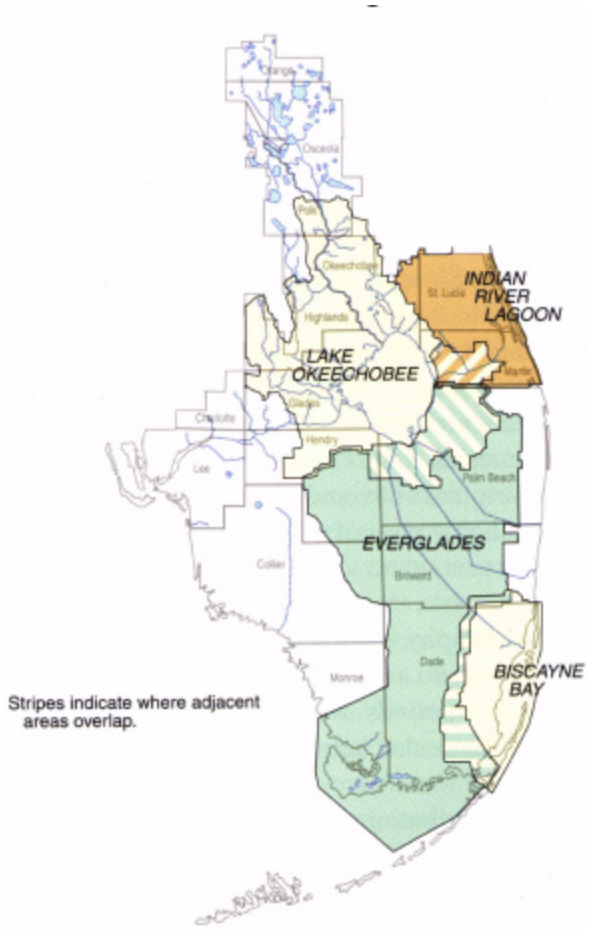


**Figure 28.** Locations of District SWIM Planning Areas (Fernald and Purdam, 1998).

The discussion below is focused on ecological conditions that have improved within the three water bodies that have active SWIM programs. Other reporting requirements are in place to continually inform the Florida Legislature on the progress of efforts to improve water quality and restore natural systems in the Everglades, including the *2000 Everglades Consolidated Report* (SFWMD, 2000e) and the *2000 Everglades Annual Report* (SFWMD, 2000f), which are available from the SFWMD.

The discussion in this section addresses ecological features such as fisheries, birds, endangered species, bottom communities including submerged algae and seagrasses, and emergent shoreline wetland communities such as marshes and swamps. Emphasis of ecological monitoring efforts has been placed on habitats rather than populations of

individual species. The assumption is made that if appropriate habitats exist, then the various species will increase in numbers to occupy those habitats. The primary ecosystem improvements include protection and restoration of mangroves and seagrasses in Biscayne Bay and the Indian River Lagoon, and control of the spread of exotic and nuisance vegetation in Lake Okeechobee.

### Lake Okeechobee SWIM

**Littoral Zone.** Much of the productivity within Lake Okeechobee occurs along the shoreline, especially in the 100,000 acres of emergent vegetation that occupy much of the western edge of the lake. The major change in littoral zone vegetation has been the increase of undesirable and exotic species such as hydrilla, melaleuca, and torpedo grass. This has led to the initiation of efforts to control their spread.

**Melaleuca Control.** Other management methods include the use of herbicides and mechanical harvesting to control the spread of melaleuca. In 1993, before initiation of the treatment program, about 25,000 acres of Lake Okeechobee's littoral zone were impacted by melaleuca. Today, all of these areas have been treated and the spread of melaleuca is largely controlled. It is anticipated that within a few years, only limited maintenance efforts will be needed to prevent reinfestation.

**Plankton.** The District has begun to collect phytoplankton and zooplankton data to quantify long-term trends in the ecosystem health in Lake Okeechobee. Periodically, excessive growth of algae occurs in the lake and creates algal blooms. These conditions are undesirable because some species produce algal toxins and because the high concentrations of algae often result in low levels of oxygen in the water at night and on cloudy days. Lack of oxygen, in turn, may result in the death of fishes and invertebrates over large areas. The occurrence of several invertebrate kills, covering large areas of Lake Okeechobee during 1986 and 1987 was one factor that contributed to the designation of Lake Okeechobee as a SWIM priority water body by the Florida Legislature. The primary measure of phytoplankton is the concentration of chlorophyll in the water. Overall growth of phytoplankton and the relative distribution of desirable and undesirable species of algae are also closely linked to the concentration of phosphorus.

### Indian River Lagoon SWIM

**Mosquito Impoundment Restoration.** There are approximately 4,700 acres of mosquito impoundments within the SFWMD portion of the Indian River Lagoon. This represents more than half of the 8,140 acres of mangroves in coastal Martin and St. Lucie counties. Through the Indian River Lagoon SWIM program, approximately 4,300 of these 4,700 acres have been reconnected to the lagoon.

**Seagrass Evaluation.** The growth and distribution of seagrasses have been monitored in the lagoon since 1986 and historical data from aerial maps are available from 1970 to the present. Preliminary analysis of available data was conducted by Woodward-Clyde, Inc. in 1994 (Woodward-Clyde Consultants et al., 1994). At that time it was estimated that submerged vegetation, including seagrasses, covered about 9,250 acres of

the 27,200 acres of potentially suitable substrate in the south segment of the lagoon. This represented a 31 percent decline from the coverage that existed in 1986, but an increase of 43 percent relative to the 6,479 acres of submerged plants that were present in 1970.

**Other Habitat Restoration Projects.** Through the Indian River Lagoon SWIM Program several habitat restoration projects are underway within the SFWMD that will result in creation/restoration of over 50 acres of wetlands. Wetlands have been created/ restored along Sim's Creek in Palm Beach County. A wetland creation project at the Jupiter Inlet Natural Area in Palm Beach County was completed in January, 2000. A shoreline restoration plan has also been completed for Blowing Rocks Preserve in Martin County. Project construction will result in creation/restoration of one mile of shoreline in phases over a 10-year period.

Additionally, the Indian River Lagoon SWIM Program is supporting a project to remove exotic vegetation from 1,000 acres of publicly owned lands along the North Fork of the St. Lucie River. The SFWMD is working closely with St. Lucie County and FDEP to coordinate wetland restoration activities that will be needed after the exotic vegetation has been removed.

**Oysters.** An additional indicator of the lagoon's health is the distribution and abundance of oysters, a target organism in the St. Lucie Estuary. The District has initiated a contract to document changes in these populations over time.

### Biscayne Bay SWIM

**Seagrasses and Mangroves.** An extensive effort was undertaken by Miami-Dade County to map the distribution of various ecological resources within Biscayne Bay during the 1980s. This map provided a sound basis to document changes in bottom communities over time. Monitoring and remapping of these areas were conducted under the SWIM Program and has shown a 25 percent increase (1,600 acres of new beds) in the coverage of seagrasses between 1984 and 1995. As part of the SWIM program, 700 acres of emergent wetland marshes and mangrove swamps have been created, primarily in northern and central Biscayne Bay.

SWIM funds also supported a project to restore freshwater flow to mangroves along the shoreline of Biscayne National Park. The intent was to divert excess flow from District coastal canals through a spreader canal to provide sheetflow across the mangroves. Facilities have been constructed, but sufficient water is not available to operate the system properly.

**Diseased Fish.** SWIM supports efforts to document the extent and nature of the occurrence of diseased and injured fish in Biscayne Bay. This problem has been impacting commercial and sports fisheries for a number of years and appears to be linked to poor water quality in certain areas of Biscayne Bay.

## Kissimmee River Restoration

Historically, the Kissimmee River meandered 103 miles from Lake Kissimmee to Lake Okeechobee through a one to two mile wide floodplain. The river and its flanking floodplain consisted of a mosaic of wetland plant communities and supported a diverse group of waterfowl, wading birds, fish, and other wildlife. Thc river was channelized between 1962 and 1971. Two-thirds of the historical floodplain was drained. One-third of the river channel was destroyed by excavation of the canal and placement of the spoil material. Implementation of the Kissimmee Flood Control Project led to drastic declines in wintering waterfowl, wading bird, and game fish populations, as well as loss of ecosystem functions.

The Kissimmee River Restoration Project will restore the ecological integrity of the damaged ecosystem by recreating the historic mosaic of wetland plant communities and restoring the historic biological diversity and functionality. The major components of the project include reestablishing historic hydrologic conditions and recreating the historical river-floodplain connectivity

The major hydrologic restoration components of the project include reestablishment of inflows from Lake Kissimmee that will be similar to historical discharge characteristics, continuous backfilling of 22 miles of canal, and removal of two water control structures. Historical river-floodplain connectivity will be recreated through acquisition of approximately 85,000 acres of land in the Kissimmee Chain of Lakes and river valley, and recarving of nine miles of former river channel (**Figure 29**).

Once these physical and hydrologic changes have been completed it is assumed that ecosystems will recover over time, restoring an estimated 40 square miles of river-floodplain ecosystem. This ecosystem will include 26,500 acres of wetlands and 43 continuous miles of meandering river. It will provide habitat for over 300 species, including three endangered species of birds: the bald eagle, the snail kite, and the wood stork.

Major components of the restoration project are the ecological evaluation programs which have been designed to evaluate the success of the project in restoring ecosystem integrity and to provide for scientifically informed fine tuning and adaptive management of the recovering and restored system. Multiple targets of success have been established and will be continuously tracked during and after the project construction.

This Kissimmee River Restoration Project was authorized by the U.S. Congress in the Water Resources Development Act of 1992. Construction will be phased over 15 years. The total project cost is estimated at $415 million. This cost will be equally shared by the State of Florida and the federal government.

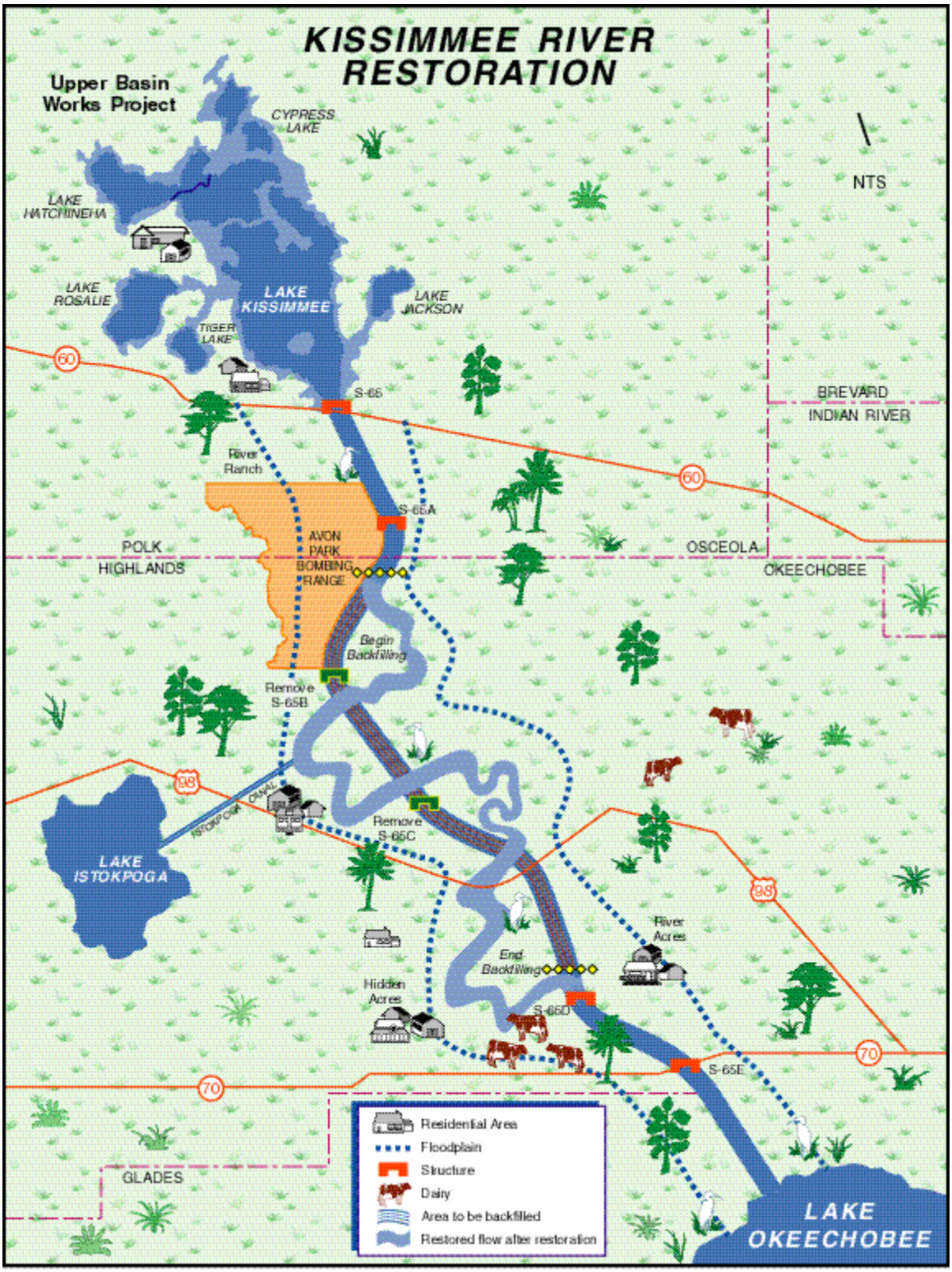


**Figure 29.** Major Features of the Kissimmee River Restoration Project.

## Everglades Restoration

Much of the Everglades restoration effort is focused on water quality and is discussed in **Chapter 5**. Efforts to restore Everglades natural systems are largely directed towards research and monitoring activities to ensure that relevant and current information is available to decision makers. Research and monitoring are presently under way to evaluate the effectiveness of restoration efforts in improving water quality and ecosystem health. Two focal areas that deal with ecosystem health include understanding ecological needs and documenting ecological changes that occur due to restoration activities.

### Understanding Ecological and Hydrological Needs

A primary consideration for restoration of the Everglades is that major components of the ecosystem have been irrevocably lost due to land development activities and drainage. The magnitude of this loss is illustrated in **Figure 30.**

At issue is how best to manage the resources that remain within the Everglades Protection Area. The FDEP and the District are scheduled to complete an evaluation of the ecological and hydrological needs of the Everglades Protection Area in 2003. This requirement is being met through modeling, experimental research, and coordination with the LEC regional water supply planning and CERP efforts. The District is developing and using six computer models that simulate the response of the natural system to water and nutrient management decisions. The District is also conducting field research to determine effects of management actions on wading birds, vegetation, tree islands, and other ecosystem components. Cooperative research studies between the District and Florida Atlantic University, which began in 1997, have shown that cattail outcompetes sawgrass under conditions of elevated nutrients and altered hydropattern.

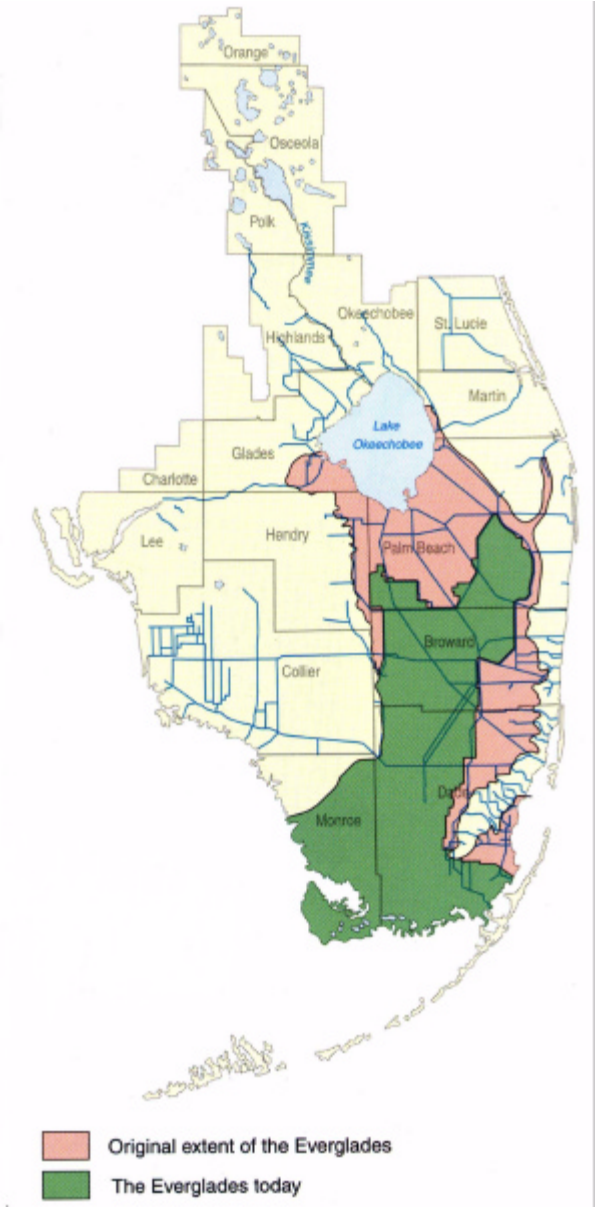


**Figure 30.** Boundaries of Historic (pre-1800) and Modern Everglades

## Documenting Ecological Changes from Restoration Activities

Three programs are documenting ecological changes that occur as a result of restoration activities:

- A mapping program to detect changes in vegetation, based on analysis and comparison of color infrared aerial photography of the WCAs
- Field monitoring to show trends in water quality, biota, and sediment erosion
- Ongoing surveys of wading birds and their food web

## Florida Bay and Southern Everglades Restoration

Located between the Florida mainland and Florida Keys, Florida Bay is the Everglades watershed's largest estuarine system. Historically, this subtropical estuary was noted for clear water, lush seagrass beds, and outstanding fishing, but has shown marked deterioration. Widespread mortality of seagrass, turbid water associated with this die-off, large and sustained phytoplankton blooms, and a decline in the commercial and recreational fisheries yield are among the problems. Hypotheses to explain the deterioration suggest that altered hydropattern, excess nutrient loading, changed circulation patterns, and lack of hurricane-induced mixing all may play a role. The District's program for Florida Bay involves the following:

- Research, modeling, and biological and water quality monitoring activities in Florida Bay to document existing resources and define restoration goals
- Research efforts in the transition zones, upstream from the bay, that are likely to be affected by water management actions
- Major upstream restoration projects in the C-111 Canal Basin and adjacent areas
- The Modified Water Deliveries Project to restore hydropatterns associated with northeastern Shark River Slough

The District is working cooperatively with the University of Florida, Florida International University, Louisiana State University, the USGS, District, FDEP, Everglades National Park, other agencies, and private organizations to implement these projects.

## Lake Okeechobee Restoration

Ecosystem restoration efforts in Lake Okeechobee are focused primarily on research concerning the lake's natural systems and control of the spread of exotic and nuisance vegetation in the littoral zone. Research efforts include ecological monitoring, determining the effects of nutrient addition, and wildlife habitat and food web studies. Efforts to control vegetation are focused on two species: chara and melaleuca. Brief descriptions of these studies are provided below.

**Zooplankton Monitoring.** Scientists are concerned that an exotic species of water flea, *Daphnia lumholtzi* may outcompete the smaller native species and become dominant during periods when larval and juvenile fishes are feeding on zooplankton. Such change in species composition could negatively impact the fisheries in Lake Okeechobee.

**Ecological Monitoring and Trends.** The District is developing a suite of standard field and laboratory analyses, including plankton biomass, taxonomic composition, primary productivity, and nutrient limitation status, that may become part of the lake's regular monitoring program to provide a holistic picture of how the ecosystem is changing.

**Lake Okeechobee Nutrient Addition Mesocosm Experiments.** Despite accelerated eutrophication of open water regions of Lake Okeechobee, the littoral marsh remains pristine and nutrient-poor. An experimental approach is being used to quantify the responses of a whole plant and animal community (mesocosm studies) to a gradient of phosphorus and nitrogen additions.

**Wildlife Survey and Habitat Evaluation Study.** Wildlife (amphibians, reptiles, birds, mammals, fish, and invertebrates) use within Lake Okeechobee's littoral zone will be evaluated over a two-year period to study the potential effects that changing hydroperiod (lake level) may have on the lake's plant and animal community.

**Lake Okeechobee Food Web Studies.** The food web in Lake Okeechobee is complex and interactions among the many species are still poorly known. Fish, invertebrates, algae, and protozoa were collected from open water and marsh locations in the lake, and a combination of stomach content analysis and chemical stable isotope analyses was used to describe the food web linkages at each site.

**Distribution and Abundance of *Chara*.** The benthic macroalga *Chara* in Lake Okeechobee may help reduce phosphorous levels and phytoplankton abundance. Measurements of *Chara* distribution, biomass, and ecophysiology suggest that reduced light levels, largely because of higher lake stages, have resulted in less *Chara* in the lake.

**Torpedo Grass Management.** Torpedo grass *(Panicum repens*), a perennial exotic grass that was introduced to Lake Okeechobee in the 1940s, has invaded more than 16,000 acres of Lake Okeechobee's littoral zone and continues to expand into new areas. The District and the University of Florida have been conducting experiments to test

different herbicides, treatment rates, treatment frequencies, and surfactants for their ability to help control torpedo grass.

**Melaleuca Mapping.** The exotic tree melaleuca (*Melaleuca quinquenervia*) was introduced to Lake Okeechobee in the 1940s and has invaded nearly 20,000 acres of the lake's upper littoral zone. A baseline map was developed in 1994. When the revised map is complete, District staff will be able to quantify changes in the melaleuca community compared to baseline conditions.

## Exotic Plant Control

Exotic plant control is an integral component of ecosystem management. Undesirable aquatic weeds (i.e., hydrilla, water hyacinths, water lettuce) affect numerous water bodies in the SFWMD. The uncontrolled expansion of these plants impedes navigation, hinders recreation, disrupts flood control structures, decreases water quality, and replaces native plant communities. Other exotic plants that replace native vegetation and disrupt wildlife habitat include melaleuca, Brazilian pepper, kudzu, Old World climbing fern, and tropical soda apple.

### Exotic Water Plant Species

Aquatic weeds are found in water bodies throughout the District. Hydrilla, water hyacinths, and water lettuce are not native to Florida and, as such, are not subject to existing biological controls. This fact, in concert with suitable growing conditions, allows these plants to reproduce and spread rapidly throughout the state.

To deal with these invasive plants, the Bureau of Aquatic Plant Management was created within the FDEP to administer the aquatic plant control programs of Chapter 369, F.S. The FDEP oversees a complex network of state, federal, and local government groups, as well as organizations of private citizens that are responsible for various aquatic plant management functions. All aspects of aquatic plant management are coordinated and managed through the FDEP to enhance efficiency, statewide consistency, and cost-effectiveness.

The FDEP enters into grant agreements with water management districts and local governments to implement programs for management of invasive aquatic plants (Chapter 16C-54, F.A.C.). These programs seek to maintain the target plant population at the lowest feasible level of funding. The District participates with the FWC, the FDEP, the U.S. Army Corps of Engineers (USACE), the University of Florida, and citizens' groups in maintenance programs for aquatic weed management. The maintenance programs include mechanical harvesting, biological controls, and herbicides. While all of these techniques are used, herbicides are the most efficient and most commonly used method. The herbicides used by the District for aquatic weed control are labeled for direct application to water.

The SFWMD will continue to coordinate aquatic weed control through the FDEP. This approach ensures statewide management and resource protection and manages the

distribution of funds appropriately. The SFWMD will work with management groups to identify alternative funding sources for aquatic weed control.

### Exotic Upland Plant Species

The District is actively continuing control efforts for melaleuca, Brazilian pepper, Old World climbing fern, Australian pine, cogon grass, tropical soda apple, and downy rose myrtle through a combination of manual removal and herbicide application.

The District has made control of melaleuca (*Melaleuca quinquenervia*) a major initiative. In 1989, the SFWMD created the Melaleuca Task Force, which included representatives from the FDEP. The Melaleuca Task Force has developed a control program involving mechanical, biological, and chemical controls. The emphasis is on testing and evaluation of biological controls. Until recently, melaleuca was spreading at a rate faster than it was being controlled. Although melaleuca may never be eradicated, it appears that SFWMD efforts are successfully containing the tree's spread within the WCAs and the Lake Okeechobee marsh. Other agencies report similar progress for work in Everglades National Park, Big Cypress National Preserve, and natural areas maintained by municipal governments. SFWMD efforts include financial support of biological control studies at the U.S. Department of Agriculture (USDA) and support of physical control work at Everglades National Park and Arthur R. Marshall Loxahatchee National Wildlife Refuge. Florida's 1994 Everglades Forever Act specifically requires the FDEP to spend $1 million annually on melaleuca control and the SFWMD to assess progress of melaleuca management every two years.

The District also supports the USDA's melaleuca biocontrol project. The USDA first released the melaleuca snout beetle (*Oxyops vitiosa*) in Florida in the spring of 1997. Preliminary results show that the insect is causing damage to new growth at several release sites. The snout beetle is the first of a suite of insects that are being studied for release. The project is funded by the District, USACE, FDEP, and Miami-Dade County.

The SFWMD will continue to cooperate with other agencies, including the FDEP, the USDA, the National Park Service, the University of Florida's Institute of Food and Agricultural Sciences (IFAS), and the U.S. Fish and Wildlife Service (USFWS) to control the spread of exotic plants throughout South Florida. These efforts will include continued use of mechanical and chemical controls and identification of biological controls for exotic pest plants. At present, manual removal of seedlings in conjunction with application of herbicides to trees is being used to address melaleuca infestations.

## ISSUES

Drainage and land filling activities have lowered water tables, modified natural hydroperiods, eliminated wetlands, degraded water quality, and diminished critical habitat for fish and wildlife. The native ecosystems of South Florida have been heavily impacted by alterations designed to increase the amount of land suitable for agricultural use and residential, commercial, and industrial development. The main issues pertaining to the

preservation and restoration of the water resource related ecosystems in South Florida are as follows:

- The need to protect the integrity and function of natural systems, including the definition and maintenance of MFLs for watercourses, lakes, and aquifers; regulatory activities; and management practices
- The need to restore the integrity and function of water resources and related natural ecosystems that have been altered by the adverse impacts of land use changes and other human activities

## Objectives, Strategies, and Performance Measures

**Core Objective NS 1:** Maintain the integrity and functions of water resources and related natural systems

The strategies will be implemented via budgeted activities in the categories of Planning, Land Acquisition, Regulation, and Monitoring and Evaluation (**Table 17**).

### Performance Measures for Objective NS 1

- **Core NS 1(a):** Number and percentage of established MFLs being maintained consistent with established recovery or prevention strategies
- **Core NS 1(b):** Number of MFLs, by water body type, established annually and cumulatively
- **Core NS 1(c):** Percentage of MFLs established in accordance with the previous year's schedule
- **Core NS 1 (d):** Total acres of wetlands or other surface water authorized by ERP to be impacted and acres required to be created, enhanced, restored, and preserved
- **SFWMD NS 1(e):** Acres of wetlands preserved as a percent of wetland acres reviewed through ERP applications; acres of wetlands reviewed; acres of wetlands impacted; acres of wetlands preserved; and acres of wetlands mitigated (may include wetlands preserved on-site)

**Table 17.** Activities Table for Core Objective NS 1.

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| **Core Objective NS 1:** Maintain the integrity and functions of water resources and related natural systems | | | | |
| **Planning** | | | | |
| Da09 | LEC MFLs | This project aims to establish MFLs for Everglades National Park, the WCAs, Lake Okeechobee, and the Biscayne aquifer (except that portion of the aquifer located in south Miami-Dade County). This effort is required by Chapter 373, F.S. | 2000 | SFWMD |
| Da12 | Rain-Driven Schedules for Everglades | The objective of this project is to develop rainfall-based delivery plans for WCAs and the Rotenberger WMA as part of the LEC regional water supply planning process. This activity has both water supply and natural systems components. Work plan assessment tools and a rainfall formula are being developed and water supply alternatives are being modeled. In FY2002, the National Environmental Policy Act Environmental Impact Statement will be initiated and a peer review is scheduled. Implementation of the plan is targeted for FY2003. | 2003 | SFWMD |
| Pa05 | Indian River Lagoon Restoration Feasibility Study | This feasibility study will examine alternatives that address the water resource problems and needs within the C&SF Project canal watersheds in Martin and St. Lucie counties. This study focuses on making improvements that will restore the environmental health of the receiving water bodies, as well as their watersheds. | 2001 | SFWMD |
| Eb18 | Florida Bay MFLs | This activity will determine MFLs for Florida Bay and predict the effects of restoration. This will be accomplished by determining the effects of high salinity on seagrass processes, survival, and production. This will include both the collection of new data and the synthesis of existing information from Florida Bay and other estuaries. | 2003 | SFWMD |
| Pa02 | Southwest Florida Feasibility Study | This feasibility study will determine in southwestern Florida water resource conditions and develop potential solutions to any problems that may be identified. The study includes Collier, Lee, Charlotte, Glades, and Hendry counties. It will provide a framework to address the following issues: health of aquatic ecosystems, water flows, water quality (including appropriate pollution reduction targets), water supply, flood protection, wildlife, biological diversity, and natural habitat. | 2004 | SFWMD |
| Ff04 | Kissimmee Basin MFL Development | This activity is for the development of MFLs for the Kissimmee Basin. MFLs for the Kissimmee River, Lake Kissimmee, and Floridan Aquifer will be developed by 2004. MFLs will be developed by 2006 for the following lakes: Tohopekaliga, Alligator, Jackson, Rosalie, Cypress, Hatchineha, Pierce, Marian, and Fish. | 2006 | SFWMD |
| Ia02 | In-Lake Research on Water Level Impacts | Research is being conducted to determine operations that will minimize harm to the natural ecosystem of Lake Okeechobee. This research involves controlled experiments to identify how lake stage affects growth and survival of submerged aquatic vegetation. | Ongoing | SFWMD |
| Jc01 | Minimum/ Maximum Flow Targets | This project is a proposed joint venture between the SFWMD and Palm Beach County Environmental Resources Management. The proposed project would utilize seagrass communities within Lake Worth Lagoon as key indicators of the health and sustainability of ecosystems within the lagoon. | Ongoing | SFWMD |

**Table 17.** Activities Table for Core Objective NS 1. (Continued)

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| Nf | Big Cypress Basin Watershed Management Plan | The Big Cypress Basin Watershed Management Plan will provide a road map for development of capital projects for the construction and improvement of the facilities presently operated and maintained by the Big Cypress Board for fulfilling its mission on flood control, water supply, water quality, and natural systems. | Ongoing | SFWMD |
| **Land Acquisition** | | | | |
| Aj | Wetlands Mitigation - K-Mart | The K-Mart wetlands are to be acquired and restored through payments from permit applicants who contribute funds to the District in lieu of performing mitigation themselves or purchasing credits from a mitigation bank. | No Date | SFWMD |
| Za | General Land Acquisition | This activity will monitor District nonspecific land acquisition and disposal projects for other programs throughout the District and for external entities. | Ongoing | SFWMD |
| Ab | Stewardship Save Our Rivers (SOR) Lands | SOR Stewardship will ensure that SOR lands are managed in a manner that is conducive to the maintenance of the integrity and functions of water resources and related natural systems. The activity includes operations and maintenance, development of public use facilities, and some mitigation. | Ongoing | SFWMD |
| Ag | Wetland Mitigation - Corkscrew Regional Ecosystem Watershed (CREW) | The CREW project is a SOR partnership project. The CREW Land and Water Trust is a private, not-for-profit organization dedicated to the preservation and stewardship of water resources and natural communities in and around the CREW. The trust coordinates the land acquisition, land management, and public use of the CREW lands. Since the CREW Land and Water Trust was formed in 1989, over 24,000 acres of the 60,000-acre project have been acquired through the District's SOR program, Lee County, the Big Cypress Basin, the state's Conservation And Recreational Lands (CARL) Program, and mitigation funds. The 60,000-acre project spans Lee and Collier counties and is the largest undisturbed watershed in southwestern Florida. | Ongoing | SFWMD |
| Ah | Wetlands Mitigation - DuPuis Reserve | The Dupuis Reserve is a 21,875-acre SOR partnership project located between the J.W. Corbett WMA and Lake Okeechobee. The reserve is actively managed by the District and the FWC. | Ongoing | SFWMD |
| An | Wetlands Mitigation - Pennsuco | The Pennsuco Wetlands are being acquired and restored through payments from permit applicants who contribute funds to the District in lieu of performing mitigation themselves or purchasing credits from a mitigation bank. | Ongoing | SFWMD |
| Ao | Wetlands Mitigation - Shingle Creek | The Shingle Creek wetlands in southern Orange and northern Osceola counties are being acquired and restored as mitigation for the Orlando Beltway Southern Connection. To date, 1,132 acres of the 7,655-acre project have been acquired. | Ongoing | SFWMD |
| Ap | Wetlands Mitigation - Upper Lakes Basin | The Upper Lakes Basin wetlands are being managed through payments from permit applicants who contribute funds to the District in lieu of performing mitigation themselves or purchasing credits from a mitigation bank. | Ongoing | SFWMD |

**Table 17.** Activities Table for Core Objective NS 1. (Continued)

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| **Regulation** | | | | |
| Ha | Environmental Resource Permitting (ERP) | This ongoing activity involves the review of permit applications. It includes the technical review and evaluation of construction plans for proposed development activities, recommendations for project design changes to ensure proposed activities meet District criteria, negotiation with permit applicants, field inspections of project sites requesting permits or wetland determinations, compliance review of project sites to ensure compliance with permit requirements, compliance review of submitted documents required by permit special conditions, preparation of technical staff reports, and preparation of requests for additional information. Also included in this element are the administrative and automation support critical to the ERP Program. | Ongoing | SFWMD |
| Hf01 | Regulation Criteria Development and Support | This activity supports the Regulation Program in developing a scientific basis for wetland protection criteria used in water use and environmental resource permitting. The activity was originated at the direction of the Governing Board and Executive Office to develop a research and monitoring program to investigate impacts to wetlands caused by water table drawdown and to develop specific recommendations for drawdown criteria that prevent significant adverse impacts. This information is needed to support rulemaking for the LWC and UEC planning regions and is a critical element in the implementation of the water supply plans for both regions. | Ongoing | SFWMD |
| Hf02 | Regulation Model Technology Development/ Application | This activity supports the Regulation Program in developing computer applications and technology for use in the water use permitting process. | Ongoing | SFWMD |
| Jm50 | Environmental Operations Protocol | Rules for low-level releases of water from Lake Okeechobee to the St. Lucie and Caloosahatchee estuaries are being developed through this activity. | Ongoing | SFWMD |
| **Monitoring and Evaluation** | | | | |
| Ia | Lake Okeechobee Research and Data Collection | This element includes the research and monitoring-related activities being conducted in Lake Okeechobee and its watershed. This information is then used when projects are planned and implemented to ensure the District's restoration-related activities are based on sound and defensible science. The key activities include in-lake research on the impacts of water level, nutrients, and invasive plants; watershed research on the fate and transport of phosphorus; modeling activities associated with the impacts of phosphorus in the watershed and the lake; BMPs associated with beef cattle operations; and monitoring activities to assess the effectiveness of restoration efforts. | Ongoing | SFWMD |
| Ja21 | Indian River Lagoon Seagrass Monitoring | Seagrasses have been identified as a valued ecosystem component for the Indian River Lagoon. This effort will obtain a current inventory of seagrass resources, identify healthy areas that may deserve special protection efforts, and identify potential problem areas that require further investigation. | Ongoing | SFWMD |

**Core Objective NS 2:** Restore degraded water resources and related natural systems to a naturally functioning condition

The strategies will be implemented via budgeted activities in the categories of Planning, Public Works Construction, Operations and Maintenance, and Monitoring and Evaluation (**Table 18**)

## Performance Measures for Objective NS 2

- **Core NS 2(a):** Acres of invasive nonnative aquatic plants in inventoried public waters
- **Core NS 2(b):** Acres of District managed lands infested with invasive nonnative upland plants by degree of land coverage
- **Core NS 2(c):** Acres of District-owned lands identified in land management plans as needing restoration; acres undergoing restoration; and acres with restoration activities completed
- **SFWMD NS 2(d):** Acres of land infested with invasive nonnative upland plants, by species inventoried
- **SFWMD NS 2(e):** Acres of cattail coverage relative to District 1995 aerial photo maps
- **SFWMD NS 2(f):** Percent increase in wading bird populations as measured by Systematic Reconnaissance Flights

**Table 18.** Activities Table for Core Objective NS 2.

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| **Core Objective NS 2:** Restore degraded water resources and related natural systems to a naturally functioning condition | | | | |
| **Planning** | | | | |
| Ib01 | Lake Okeechobee SWIM Plan Implementation | This activity includes work required to update the *1997 Lake Okeechobee Surface Water Improvement and Management Plan* (SFWMD, 1997b). | Ongoing | SFWMD |
| Da12 | Rain-Driven Schedules for the Everglades | The objective of this project is to develop rainfall-based delivery plans for WCAs and the Rotenberger WMA as part of the LEC regional water supply planning process. This activity has both water supply and natural systems components. Work plan assessment tools and a rainfall formula are being developed and water supply alternatives are being modeled. In FY2002, the National Environmental Policy Act Environmental Impact Statement will be initiated and a peer review is scheduled. Implementation of the plan is targeted for FY2003. | 2003 | SFWMD |

**Table 18.** Activities Table for Core Objective NS 2. (Continued)

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| Eb04 | Establish Ecological and Hydrologic Needs for the Everglades Protection Area | The effects of water level, flow, and water quality on key performance measures of sloughs and wet prairies will be determined through this activity. Plant community structure and productivity will be measured and recommendations for the restoration of these communities will be made. RECOVER (REstoration, COordination and VERification) conceptual models will be assessed through measurements of baseline status, history, and development of ridge and slough landscape. | 2003 | SFWMD |
| Da11 | South Miami-Dade County Integrated Water Resource Strategy | The long-term objective of this project is to identify management strategies necessary to ensure water quality protection, flood protection, water supply, and environmental protection and enhancement, in response to anticipated changes in demographics, land use, and regional ecosystem restoration activities in south Miami-Dade County. The short-term objective is to focus on countywide water resource and water supply efforts. FY2001 monies are being used to support the CERP. | Ongoing | SFWMD |
| Jd20 | Biscayne Bay SWIM Plan Update | The SWIM Act requires an update of the Biscayne Bay SWIM Plan. The last update was in 1995 (SFWMD, 1995b) The District is working with the USACE, Miami-Dade County, and the Florida Power and Light (FP&L) Company to implement this project. This project includes continued analysis to determine the freshwater needs of Biscayne Bay and to establish MFLs for the bay by 2004. | Ongoing | SFWMD |
| **Land Acquisition** | | | | |
| Fd | Kissimmee River Restoration Land Acquisition | This activity will enable the District to acquire 12 to 15 ownerships for the Kissimmee River Restoration Project by the specified deadline. Land acquisition costs include relocation costs. | 2011 | SFWMD |
| **Public Works Construction** | | | | |
| Pb03 | Western C-4 Structure Critical Project | This activity is for the East Coast Canal Structure C-4 Critical Restoration Project. The District will be responsible for the installation of remote operation instrumentation once the structure is complete. Removal of Structure G-119 will occur when the acquisition of the Pennsuco Wetlands is completed. Interim operation of the structure will be compatible with existing land use ordinances until full land acquisition is completed. The District will be reimbursed $20,000 for the design and installation of electronic equipment that will allow remote operation of the structure. The design of the water control structure will occur during FY2000 and construction is scheduled for FY2001. | 2001 | SFWMD |
| Pb02 | Tamiami Trail Culverts (West) Critical Project | The project is located on the Tamiami Trail (U.S. 41) in Collier County between State Road 92 and 50-Mile Bend (a distance of approximately 43 miles). The purpose of this project is to increase the number of north-south flowways by adding water conveyance structures under Tamiami Trail in locations that will restore a more natural hydropattern. In addition, plugs will be installed in the existing borrow canal at appropriate places to reduce east-west flow. This project will help restore a more natural hydropattern to southern Big Cypress Basin and coastal areas to the south including the Big Cypress National Preserve. | 2002 | SFWMD |

**Table 18.** Activities Table for Core Objective NS 2. (Continued)

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| Pb05 | Lake Trafford Restoration | This activity is for Critical Ecosystem Restoration Project development. The District is the local sponsor in partnership with USACE and the FWC. | 2003 | SFWMD |
| Eh | C-111 Project Implementation | The C-111 Project consists of both structural and nonstructural modifications to the existing works within the C-111 Basin to promote more natural hydroperiods in Taylor Slough and the eastern panhandle ecosystems of Everglades National Park. Flood protection within the C-111 Basin east of the L-31N and C-111 canals will be maintained. | 2004 | SFWMD |
| Ei | Modified Water Deliveries | This activity will implement the Modified Water Deliveries Project, which is designed to restore hydrologic balance between western Shark Slough and northeastern Shark River Slough. This will benefit Everglades National Park flora. | 2004 | SFWMD |
| Pd13 | Florida Keys Tidal Restoration | The purpose of this feature is to restore the tidal connection that was eliminated in the early 1900s during the construction of Flagler's railroad. Restoring the circulation to areas of surface water that have been impeded and stagnant for decades will significantly improve water quality, benthic floral and faunal communities, larval distribution of both recreational and commercial species (i.e. spiney lobster), and the overall hydrology of Florida Bay. This feature includes the use of bridges or culverts to restore the tidal connection between Florida Bay and the Atlantic Ocean in Monroe County. The four locations are as follows: 1) Tarpon Creek, just south of Mile Marker 54 on Fat Deer Key (width 150 feet); 2) unnamed creek between Fat Deer Key and Long Point Key, south of Mile Marker 56 (width 450 feet); 3) tidal connection adjacent to Little Crawl Key (width 300 feet), and 4) tidal connection between Florida Bay and Atlantic Ocean at Mile Marker 57 (width 2,400 feet). | 2005 | SFWMD |
| Pb05 | Lake Trafford Restoration | The water quality of the headwaters (Lake Trafford) of the Corkscrew Swamp and Camp Keis Strand have been targeted for protection. Lake Trafford has poor water quality, extensive muck accumulations, loss of native submergent plant communities, periodic aquatic weed infestations, and numerous moderate fish kills. Poor water quality is attributed to internal nutrient cycling from extensive organic muck deposits throughout the lake's basin. Water quality within Lake Trafford will be improved by lakewide organic sediment removal. | 2005 | SFWMD |
| Pd15 | S-356 Structures (Miami-Dade County) | This feature includes relocation of the Modified Water Deliveries structure (S-357) to provide more effective water deliveries to Everglades National Park. New discharges to Everglades National Park will be designed to meet applicable water quality criteria. | 2008 | SFWMD |
| Pd23 | Additional S-345 Structures | This project includes the construction of new water control structures and the modification or removal of levees, canals, and water control structures in WCAs-3, located in western Broward County. | 2009 | SFWMD |
| Pd09 | G-404 Pump Station Modifications | This feature includes relocation and modifications to pump stations and development of a spreader canal system located in the northwestern corner and west-central portions of WCA-3A in western Broward County. The purpose of this feature is to increase environmental water supply availability, increase depths, and extend wetland hydropatterns in the northwestern corner and west-central portions of WCA-3A. | 2009 | SFWMD |

**Table 18.** Activities Table for Core Objective NS 2. (Continued)

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| Pd18 | Southern Golden Gate Estates Hydrologic Restoration | The Southern Golden Gate Estates Hydrologic Restoration Project is a CERP project developed in partnership with the USACE. The project will reestablish historic flowways, sheetflow, and hydroperiods of wetlands to near historic levels within the Southern Golden Gate Estates. It will also improve water quality and increase water supply for aquifer recharge. | 2010 | SFWMD |
| Pd22 | Lake Worth Lagoon Restoration | In Palm Beach County, the Lake Worth Lagoon Estuary is the receiving water body for most of the urban watershed. Sediment laden flows from the C-51 Canal have resulted in accelerated sedimentation of Lake Worth Lagoon (the receiving waters). The restoration project involves three phases. Phase I will examine both the quantity and quality of bottom sediment accumulations within the C-51 Canal and the downstream discharge area within the lagoon. Phase II will develop a project plan to provide for sediment removal or capping that could include creating a series of sediment traps along the C-51 Canal where sediment accumulations increase. Phase III will involve the removal of bottom sediments within the C-51 Canal, as well as implementing a prototype project to either remove or cap the organic bottom layer within the lagoon. | 2011 | SFWMD |
| Fb03 | Kissimmee River Restoration Design | This activity supports the District's participation with the USACE in the design and construction of project components that will ensure the Kissimmee River Restoration Project meets its restoration goals. These components include the Avon Park fence, the Lake Istokpoga boat ramp, and the Oak Creek 100-year flood line modeling. | 2011 | SFWMD |
| Fb | Kissimmee River Restoration Engineering | This element supports the District's participation with the USACE in the analysis and design of project construction elements for meeting flood protection constraints and ecosystem restoration goals for the Kissimmee River Restoration Project. | Ongoing | SFWMD |
| **Operations and Maintenance** | | | | |
| Ee | Everglades Exotic Species Control | This activity provides for the elimination and monitoring of exotic plants within the Everglades. | Ongoing | SFWMD |
| Pd05 | Holey Land WMA Regulation Schedule | Modification to the current operating plan for the Holey Land WMA will be made to implement rain-driven operations for this area. Water deliveries are made to the Holey Land WMA from the Rotenberger WMA or, if Rotenberger WMA flows are insufficient, from STA-3 and STA-4. The deliveries are assumed to be of acceptable water quality. These new operational rules are intended to improve the timing and location of water depths within the Holey Land WMA. | 2001 | SFWMD |
| Pd06 | Rotenberger Regulation Schedule | Modification to the current operating plan for the Rotenberger WMA will be made to implement rain-driven operations for this area. Water deliveries are made to the Rotenberger WMA from STA-5. Discharges from the Rotenberger WMA are made to the Holey Land WMA. The deliveries are assumed to be of acceptable water quality. These new operational rules are intended to improve the timing and location of water depths within the Rotenberger WMA. | 2001 | SFWMD |

**Table 18.** Activities Table for Core Objective NS 2. (Continued)

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| Id | Lake Okeechobee Exotic Control | This activity allows for exotic control for Lake Okeechobee. Control of melaleuca and other exotic plants is critical for Lake Okeechobee preservation and restoration. If not managed, plants like melaleuca form dense monocultures, displacing all other plant communities. | Ongoing | SFWMD |
| **Monitoring and Evaluation** | | | | |
| Bb08 | STA/Everglades Nutrient Removal (ENR) Project Optimization, Research, and Modeling | This activity includes 1) field collection and laboratory analysis of water quality, vegetation, and sediment samples associated with research and monitoring efforts of the ENR Project; 2) development and implementation of the Wetland Water Quality Model; 3) analysis of nutrient removal performance data from other South Florida wetlands; and 4) optimization experiments that will be conducted in the ENR test cells. This work is all part of the District's STA Optimization Research Program. The District is mandated by the Everglades Forever Act to conduct research on optimizing performance of the STAs. | 2004 | SFWMD |
| Eb17 | Florida Bay Research - Seagrass Mortality and Algal Blooms | This research activity will measure the effects changes in timing and the amount of freshwater flow to Florida Bay has on seagrass habitat viability and restoration. This activity will also measure algal bloom response, including spatial extent, persistence, occurrence of harmful blooms, and impacts on other living resources (benthos, seagrasses, and fisheries). This activity will also provide recommendations on water management operations which will achieve the restoration of habitat and water quality within Florida Bay. | 2004 | SFWMD |
| Eb15 | Florida Bay - Ecological Response to Restoration Activities | This activity supports research studies to determine the ecological response of Florida Bay to restoration activities. The ecological conditions of the southeastern Everglades will be monitored to determine the effects of changes in water flow and hydroperiod associated with structural and operational changes. Research will also include the measurement of nutrient inputs from the C&SF Project; determination of the nutrient cycle (nutrient transport, transformation, retention, and release) for the wetlands, including the salinity transition zone of Florida Bay; and the determination of the amount of nutrient loading to Florida Bay. In the C-111 Basin and Taylor Slough, plant community composition and productivity and soil accretion or loss will be measured. Spatial and temporal changes in periphyton and water quality conditions in response to hydrologic restoration in the southern Everglades will be monitored. | 2004 | SFWMD |
| Fa | Kissimmee Basin Restoration Evaluation and Assessment | Research and evaluation data will be used to evaluate the success of the Kissimmee River Restoration Project, fine tune reconstruction phases, and provide for adaptive management of the restored ecosystem. Outputs include publications, technical reports, and an integrated database. | 2011 | SFWMD |

**Table 18.** Activities Table for Core Objective NS 2. (Continued)

| FY2001 Budget Activity Code | Strategies | Description | Year Complete | Responsible Entity |
|---|---|---|---|---|
| Eb05 | Everglades Food Web/Wading Birds Hydrologic Effect | This effort will generate a series of scientific publications: 1) analysis of systematic reconnaissance flight wading bird surveys from former contracts and other agencies to determine wading bird distributions and identify depth thresholds that preclude wading birds from feeding successfully; 2) scientific publication examining the amount of movement various species of wading birds exhibit as an indication of how likely they are to be affected by local restoration projects; 3) reports and scientific publications that define fish and aquatic macroinvertebrate populations in the WCAs; 4) scientific publications containing recommendations for water depths and durations that promote the existence of healthy tree islands and associated wildlife; 5) annual report on the numbers of nesting wading birds in South Florida; 6) scientific publications of test cell experiments to identify the optimum and minimum water depths necessary for successful foraging. | Ongoing | SFWMD |
| Ka | Hydrologic Monitoring | This activity includes long-term hydrologic data collection, database management, routine data reporting, and data evaluation. These data document the operation of the C&SF Project and provide data for the CERP, restoration of the Kissimmee River, the Everglades, Florida Bay, and Lake Okeechobee, and water resource planning and implementation | Ongoing | SFWMD |
| Pg | Monitoring and Evaluation (RECOVER) | This element is a grouping of activities to organize and apply scientific and technical information in ways that are most effective in supporting the objectives of the CERP. Activities include the coordination and application of the components of the Applied Science Strategy during the implementation of the CERP. | Ongoing | SFWMD |
| Ia | Lake Okeechobee Research and Data Collection | This element includes the research and monitoring related activities being conducted in Lake Okeechobee and its watershed. This information is then used when projects are planned and implemented to ensure the District's restoration related activities are based on sound and defensible science. The key activities include in-lake research on the impacts of water level, nutrients, and invasive plants; watershed research on the fate and transport of phosphorus; modeling activities associated with the impacts of phosphorus in the watershed and the lake; BMPs associated with beef cattle operations; and monitoring activities to assess the effectiveness of restoration efforts. | Ongoing | SFWMD |
| Ib01 | Lake Okeechobee SWIM Plan Implementation | This activity includes work required to insure that the *Lake Okeechobee Surface Water Improvement and Management Plan* (SFWMD, 1997b) is implemented. | Ongoing | SFWMD |